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Land Use Transformation Process in Chachoengsao Province, Thailand

Boonrawat Pruksanubal*

Faculty of Architecture, Chulalongkorn University, Bangkok 10330, Thailand

Abstract

Chachoengsao province is to the east of Bangkok Metropolitan where has been promoted to be a new core industrial space according to the 5th National Economic and Social Development Plan. This province has been a significant area where supplied food resources for surrounded areas. The objectives of this research are to study the land use transformation process of Chachoengsao province and the impact of the transformations. Nowadays, it is becoming a successful location regarding the increasing of industrial investments. Consequently, the economic structure of Chachoengsao has been shifted from agriculture to industrial. Land use also has been changed rapidly.

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Keywords: Land use; transformation; industrial; agriculture

1. Introduction

Bangkok, which is a primate city, was expanding along the main transportation routes linking its environ and became Bangkok Metropolitan Region (BMR). BMR facilitated the growth of trading, services and industries;

* Corresponding author. Tel.: +66-086-012-4569.
E-mail address: boonrawat_p@hotmail.com

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consequently, economic activities concentrated in this region.

The rapid population growth led to the allocation of limited land for economic activities and residential areas. Therefore, land prices rocketed and immigrant workers had to bear high cost of living. A crowded area gave rise to environmental and health care problems. Entrepreneurs were looking for new locations close to main transportation routes and deep-sea ports. According to the 3rd National Economic and Social Development Plan, the government promoted new kinds of industry such as natural gas. However, the rapid growth of Bangkok caused inequality in terms of economy and social development because main industries and services are clustered in this city while main activities of other provinces related to agriculture.

Based on the 5th National Economic and Social Development Plan (1982-1986), the government aimed to develop other regions so that they would be developed as equally as Bangkok. The government designed a specific development plan for each region depending on its potential. One of these regions was three provinces on the east coasts. Chonburi, Rayong and Chachoengsao covered about 8.3 million rai. The government planned to 1) specify the use of land, 2) offer incentives to entrepreneurs to invest in major industries, 3) provide infrastructure to encourage investment, 4) provide training on skill development and public health services, 5) set up measures for environmental control and 6) map out a master plan to develop areas on the east coast (NESDB, 1981).

These three provinces or the Eastern Seaboard Region could attract both local and foreign investors because of its strategic location. This region is only 75-170 kilometers away from Bangkok, borders the Northeast, which can supply labor and raw materials and equipped with a deep-sea port, Laem Chabang Port. Plus, it is not far from an international airport, Suvarnabhumi Airport. And it is directly linked to the Motorway (Bangkok-Chonburi), the Bang Na-Bang Phli- Bang Pakong Expressway, Hi-speed Train (Bangkok-Rayong) and Bi-rail project. According to the Eastern Seaboard Plan, Laem Chabang is designated for medium and small industries while the area between Sattahip and Rayong is for major industries such as petrochemical industry, gas refinery and steel. Since, this area is adjacent to Sattahip Port, which can facilitate the import of raw materials and the seaport of products. Industrial development needs accessibility advantages both time and cost of industrial linkages on Bangkok Metropolitan Eastern corridor (Panitchapakdi, 2001), see Fig. 1.

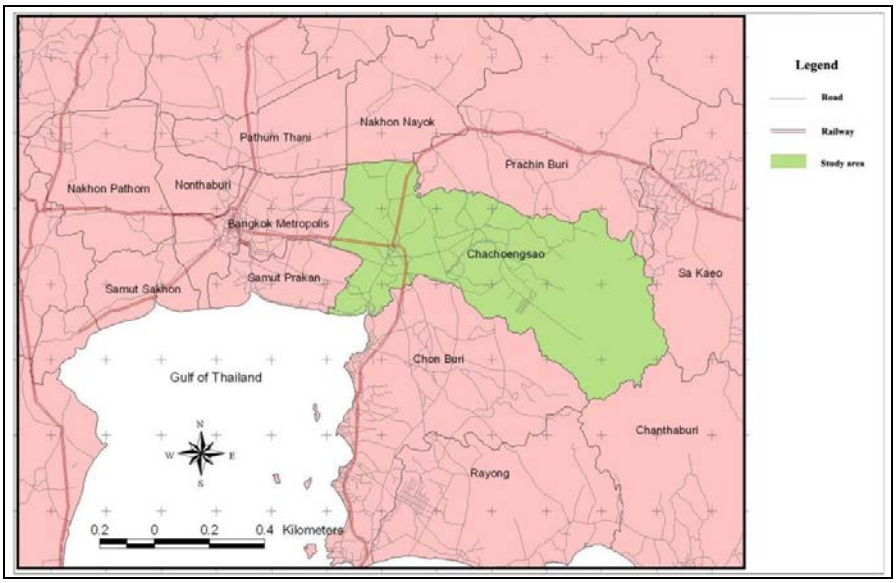

Fig. 1. Location of Chachoengsao Province

After the implementation of the plan, the Eastern Seaboard Region is the second largest industrial area of the country after Bangkok Metropolitan Region. The registered investment of the East including the Eastern Seaboard

Region accounted for 50% of the total registered investment in 1977 and rose to 64.7% from 1995. During this period, 644,000 workers were employed, 242,000 of whom worked in the Eastern Seaboard Region. In 1996, the per capita income in this region stood at 2.76 as high as that of the national average (JICA, 2001).

Due to the investment distribution, the Board of Investment offered incentives to promote additional investment and relocation in three promotional zones based on local earnings and facilitates. As a result, promotional benefits vary (BOI, 2013).

In conclusion, the government played an important role in developing specific industrial areas. In response to this, the government organization launched projects to meet the urban growth and increased economic activities. The examples of activity are the construction of water reservoirs for additional household and industrial use, the improvement in urban planning to gain maximum benefits of land use and the establishment of the industrial estate. Meanwhile, the companies that received investment promotion carried out their activities in the government or private industrial estates. These led to a dramatic change in land use. And this is why the researcher would like to study a change in the land use pattern in Chachoengsao, which is part of designated site for major industrials and to study the impacts of such change.

This study is derived from two main sources; 1) reviewing secondary data such as the National Economic and Social Development Plan, local policies, provincial statistic data, historical data and aerial photographs, etc. and 2) field study. Field surveys were done to compare the change of land use between the secondary data and the existing. The researcher also had interviewed some key informants such as local people, local officers, investors, and NGOs to get more detail about the present situation in the study area.

2. Background of study area

Chachoengsao Province, covering an area of 5,351 square kilometers, is 75 kilometers to the east of Bangkok. There are three types of topography. First, the plain alluvial accounting for 37.7% of the province that plays an important role the province economy. Second, the plain corrupted accounting for 51.1% of the province where field crops are grown. Third, the plateau and mountainous area accounting for 11.2% of the province where the Bang Pakong River, the major river of this province, is found (Thailand Ministry of Industry, 2011).

Chachoengsao is considered a historical province since the San Sap Canal was dug to connect the Chao Phraya River and the Bang Pakong River. During the early Rattanakosin period, Laos, Cambodia and Vietnam were annexed to Siam, resulting wars. The Siamese army moving along the Samrong Canal to deal with unrests in those countries was not convenient; as a result, a canal had to be dug to shorter the time spent on the journey. In 1837 during the reign of King Rama III, the Samrong Canal was dug extended from Hua Mak to Bang Khanak covering 53-48 kilometers. It took three years to finish the digging. During the reign of King Rama V, (1878-1880) the Pravejburirom Canal was dug to link the Chao Phraya River with the Bang Pakong River. Therefore, the travel to Chachoengsao could be shortened, and at least the area of 147.2 square kilometers were developed for growing rice, some of which was exported (Arsvai, 1978). Later, claims for the land along the Pravejburirom Canal were staked out, and four canals were branched off this canal along the north-south direction. These resulted in more settlement and agricultural practices.

This province is part of the Eastern Seaboard Project according to the 5th National Economic and Social Development Plan. Three industrial estates were set up. They are Wellgrow in Bang Pakong District, Gateway City in Plang Yao District and TDF in Bang Pakong District, totaling 11.98 square kilometers. Plus, there are 1,573 factories outside these industrial estates (Ministry of Industry, Thailand, 2011). More people relocated from the inner city on the Bang Pakong River to these areas, see Table 1.

Table 1. Major Events from 1876 to present are concluded in the timeline table as follows:

Year	Event
1876	Digging of the Nakorn Neungkhet Canal
1878	Digging of the Pravejburirom Canal
1887	Digging of the Preng Canal
1888	Digging of the Luang Pang Canal and the Udom Chonlajorn Canal
1890	Digging of the Rangsit Canal
1901	Digging of the Bang Pli Yai Canal and the Niyom Yatra Canal
	Issuance of the first land deed of Thailand
1905	Construction Bangkok-Chachoengsao railroad
1966	The Board of Investment of Thailand)BOI)
1968	Construction of Highway 304 (Chachoengsao- Kabinburi)
1972	The 3rd National Economic and Social development Plan
1974	Construction of Highway 331 (Panom Sarakham-Sattahip
1977	Construction of the Bang Pakong Powerplant
1982	The 5th National Economic and Social Development Plan
	Eastern Sea board Development Program (ESB) 1
1987	Construction of Klong Rabom Reservoir
1989	Wellgrow Industrial Estate (Bang Pakong District)
	Implementation of Bang Pakong River and its Branches
1990	Gateway City Industrial Estate (Plaeng Yao District)
1991	Double A Paper Industry (Phanom Sarakham District)
1993	East Water
1996	Toyota Motor (Thailand) Gateway Plant (Plaeng Yao District)
	Construction of Si Yat reservoir
	Construction of Bang Pakong Check dam in 1996
	Eastern Sea board Development Program (ESB) 2
1997	Railway Map Ta Phut-Rayong
1998	Motorway 7 Bangkok-Chonburi
2000	Highway 34 Bang Na-Bang Pakong
2001	304 Industrial Park II (Phanom Sarakham District)
2003	Ban Ur-arthorn Project (Low-cost housing project by National Housing Authority)
2004	Bi-rail Chachoengsao-Si Racha-Leam Chabang
2005	Suvarnabhumi Airport
2006	Implementation of the Master Plan of Chachoengsao Province
2007	TFD Industrial Estate (Bang Pakong District)
	Toyota Motor (Thailand) (Ban Pho District)
2011	Implementation of the Master Plan of Bang Pakong Community
2012	Implementation of the Master Plan of Ban Pho Community

3. Peri-urbanization and land use pattern

In the developing-country scenario, peri-urban refers to sprawling urbanization. It is a transitional area between the urban area and the rural area. What happen in the peri-urbanization is parallel to that in the urban area (Revetz J., 2013). Webster and Muller described peri-urbanization as an area existing between the urban and rural area whose main economic activities are related to agriculture. This area is becoming urban –like in every aspect and could be 150 kilometers away from the city center. The peri-urbanization, as for developing countries, in particular, exhibits changes in the economic structure and employment structure. The agricultural-based economy is changed into the industrial-based one, and the population growth is rapid. Such factors result in urbanization that leads to non-registered population, changes in land use pattern and an increase in land prices. The Eastern Seaboard Region is an example of the peri-urbanization (Webster and Muller, 2004). Three provinces in Eastern Seaboard were also defined as part of the Extended Bangkok Metropolitan Region (EBMR) according to TDRI (Robinson, 1995). The changes in the land use pattern in the peri-urbanization can be determined by the Gross Provincial Product (GPP). GPP reveals that the production sector yield higher returns and by the land use at different timeframes based on aerial or satellite photographs.

4. Result

One of the information that can be used to consider the change in land use pattern is Economic Base Analysis. According to the statistical data of Chachoengsao province, the data are analyzed to determine the development of the land use pattern in Chachoengsao.

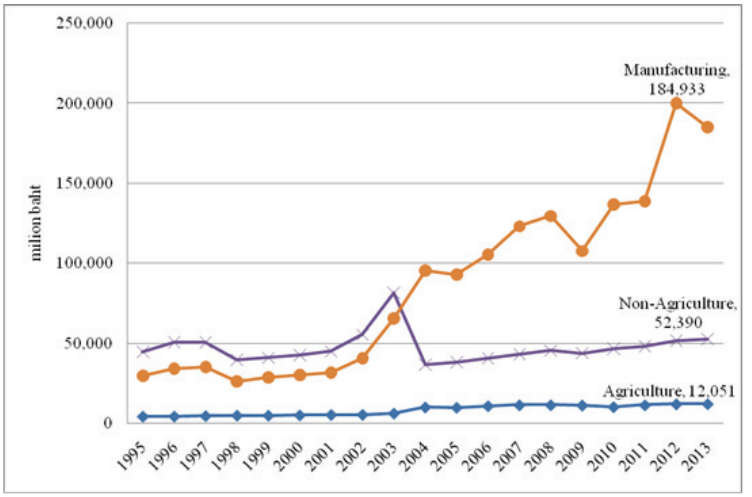

Fig. 2. Gross Provincial Product (GPP) of Chachoengsao Province Year 1995-2013
(Source: Office of the National Economic and Social Development Board, 2014)

According to GPP, the agricultural earnings between 1985 and 1987 were higher than those of the manufacturing sector. In 1985, the agricultural earnings stood at 4,081 million baht while the manufacturing earnings stood at 2,075 million baht. In 1986, agricultural earnings were at 4,737 million baht while the manufacturing earnings at 3,588 million baht. In 1987, the agricultural earnings were at 4,688 million baht while the manufacturing earnings at 4,062 million baht. However, since 1988, the manufacturing earnings kept increasing. Due to the 1997 economic crisis, the manufacturing earnings in 1998 dropped but they increased slowly and after 2002, they skyrocketed to 65,732 million baht. As for the non-agriculture, the earnings, which were from mining, construction, electricity, gas, tap water, retailing-wholesaling, transportation, government and private service, increased. And it decreased in the same manner as those of the manufacturing sectors. Meanwhile, the agricultural earnings from 1985 to 2003 did not vary much, from 4,000 to 6,100 million baht, see Fig 2.

Between 2004 and 2013, the manufacturing earning were annually more than 93,000 million baht. Even though the non-agricultural earnings were higher than the agricultural earnings, they did not follow the pattern of the manufacturing earnings. The non-agricultural earnings did not increase much, varying from 36,000 to 46,000 million baht. The agricultural earnings were the smallest, varying from 9,700 to 11,400 million baht.

Location Quotient (LQ), which is used to determine specialization in comparison with other areas (Thailand. Department of Public Works and Town & Country Planning, 2008), was used to determine the earnings of 16 sectors of production.

According to the 2013 data, the LQ of the manufacturing in Chachoengsao, when compared to that of the whole country was LQ>1 (LQ=2.56). It is indicated that manufacturing is the basic production of Chachoengsao. It was based on the assumptions that 1) the production effectiveness was the same in every area, 2) the average level of consumption was the same in every area. 3) the net export to foreign countries stood at zero in every production branch and 4) the exported goods were not imported.

Table 2. Gross provincial product and location quotient (LQ) in 2013

Sector	Whole country Yi	Chachoengsao Province Xi	LQ (Xi/Xt) /(Yi/Yt)
Agriculture, hunting and forestry	517,203	9,421	0.67
Fishing	125,457	2,356	0.69
Mining and quarrying	242,209	187	0.03
Manufacturing	2,642,341	184,933	2.56
Electricity, Gas, and Water Supply	290,589	7,086	0.89
Construction	235,084	5,429	0.85
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	1,344,121	17,056	0.46
Hotels and restaurants	424,474	632	0.05
Transport, storage and communications	870,586	6,994	0.29
Financial intermediation	554,537	2,795	0.18
Real estate, renting and business activities	765,853	6,071	0.29
Public administration and defence; compulsory social security	500,900	2,256	0.16
Education	318,231	3,632	0.42
Health and social work	158,194	1,256	0.29
Other community, social and personal service activities	178,394	746	0.15
Private households with employed persons	17,731	83	0.17
SUM	9,185,904	250,933	

(Source: Office of the National Economic and Social Development Board, 2013)

As for the general land use of Chachoengsao in 1994 and 2008, it was found that there was an increase of land use for fish and shrimp farm. Originally, it was around the estuary of the Bang Pakong River. Later, it was extended to the upper part of the province. The area for industrial estates and stand-alone factories was expanded in Bang Pakong District and Ban Pho District. The residential areas and the manufacturing sites clustered around the intersections and along the roads, see Fig. 3. Aerial photographs were also used to describe the transformation of land use. According to the left picture, the mangrove covered most of the area and further upstream, the land was used for cultivation. The settlement was clearly seen in now Bang Pakong Municipality whereas in 2002, the mangrove area was turned into the residential area including large housing project and blocks of flats. The

population density was upgraded many areas to the municipal level. Factories, fish farms, and shrimps farms mushroomed in the cultivation areas, see Fig. 4.

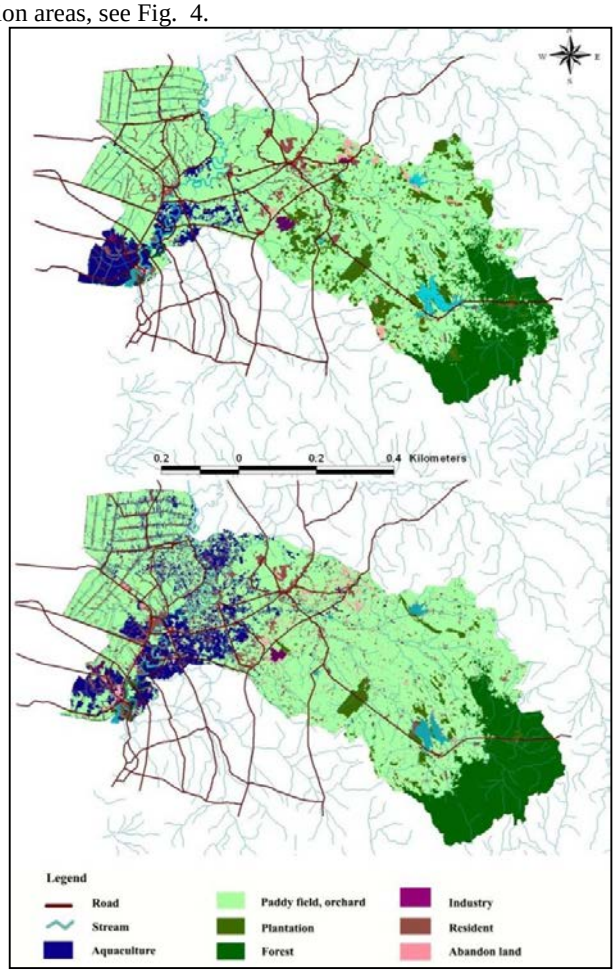

Fig. 3. Land use of Chachoengsao Province (a) Year 1994; (b) Year 2008
(Source: Land Development Department, 2008)

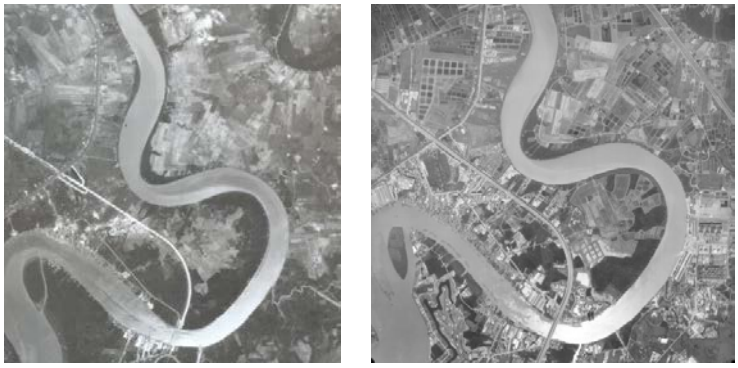

Fig. 4. Aerial photographs of the estuary of the Bang Pakong River in (a) 1967; (b) 2002
(Source: Royal Thai Survey Department cited in Kingsuwan, 2010)

5. Discussion

Agriculture used to be the basic production of Chachoengsao because of not only fertile land but also many canals that were used for transportation and irrigation. As a result, rice and fruits were grown and could be exported domestically and internationally. This province was a major food producer in the country.

The globalization has driven Thailand to promote the industrial sector to earn more income. The industrial promotion has been stipulated in the National Economic and Social Development Plans. Certain areas including Chachoengsao Province are designated as new industrial sites. In addition to more roads and railways, a deep-sea port and reservoirs such as Klong Rabom Reservoir and Si Yat Reservoir were constructed to supply water for household, agricultural and industrial use. However, this supply cannot meet the increasing demand. As a result, private companies invested in manufacturing water for industrial purposes in the eastern region. Plus, to encourage foreign investment, tax reduction on imported machinery is granted to foreign entrepreneurs who would like to set up factories in the designated zones; consequently, the number of factories have increased. The major earnings, as a result, of this region are from industries and manufacturing becomes the major production of Chachoengsao.

6. The introduction of manufacturing VS the changes in agricultural practices

The introduction of manufacturing caused Chachoengsao to lose agricultural areas to factories. The farmers sold their land to outside investors. Although the agricultural earnings in this province are lower than those in the manufacturing sector, in general, they stay the same because farmers use more labor-saving tools instead of using manpower like in the past. And they also use chemicals to shorten the time for crops to yield so farmers can grow their crops for more than one or two seasons. Furthermore, more economic crops such as rubber, eucalyptus and cassava are grown intensely and single. Mono cropping has affected the soil quality in the long run. More chemicals are used to accelerate yields and improve soil quality, in addition to more water required for cultivation.

The introduction of manufacturing into Chachoengsao means more land is required for factories, more immigrant workers that have to share resources with the locals and more housing near factories industrial estates. Different types of the house are offered by private real estates and the government such as the Ur-arthorn Project for low-income earners.

In addition to a change in cultivation practices, types of the crop are changed depending on the global demand and the returns. In many areas where rice, mango, sugar cane and areca palms were grown are now converted into fish farms and shrimp farms, white shrimps, in particular, see Fig 5. They are in high demanded and high resistant to diseases. Farmers earn more from white shrimps than from rice or other crops. Therefore, the land use pattern has been changed according to external driving forces.

Fig. 5. (a) Fish farm; (b) Shrimp farm

7. Role of master planning

Since the Eastern Seaboard Project, the developers came to acquire the land. The land use plan is needed in order to control the land development and reserve natural environment. The Master Plan has been implemented both at provincial and major communal levels such as Bang Pakong District and Ban Pho District so that the land use can be

appropriately assigned. However, the planning was introduced after the introduction of manufacturing, so it is not easy to put the land use under control, creating the balance between agricultural practices and manufacturing activities on the fertile soil. To achieve this and meet various needs are challenging since conflicts could arise among stakeholders or between stakeholders and the government officials.

8. Impacts

Changes in the land use pattern have impacts on the following aspects:

- Natural resources. The manufacturing and the agricultural sectors as well as the household sector use a lot of water and contaminate a lot too. Large-size factories treat waste water before releasing it to the environment, but small-size ones, the agricultural sector, and the household do not, thus adversely affecting the natural water resources. Forest and Mangrove areas are decreased because the farmers tried to claim the land for agriculture and settlement. The natural forests are replaced by mono-cropping and aquaculture.
- Economy. The real income that benefits the locals is considered small when compared to the income earned from domestics and international investment. The returns that the locals obtain are wages and earnings from services and retailing to factory staff. In terms of macro-economy, the economic returns are high and can attract a lot of international investment.
- Society. Since the implementation of the specific area development projects, most of the land in Chachoengsao has been acquired and organized by land developers (Robinson, 1995). The land prices in those areas have increased, and this is one of an incentive for some farmers to sell their land to entrepreneurs. After that, these farmers have to work for a factory or rent another piece of land to do cultivation. The locals feel insecure about the land that has provided them food and money to take care of their family. These are a fraction of impacts of the changes in the land use pattern.

9. Conclusion

The global economic forces strongly affect the mapping out of the national development plans of the developing countries, resulting to shift their economic base to meet the global demand. The huge returns expected from foreign investment urge the government to improve its infrastructures such as motorway, railroad, airport, deep-sea port power plant, dam, and reservoir so that it can facilitate more investment. New activities such as manufacturing in an area inevitably affect other activities such as commerce and services. They also attract immigrants and the land use pattern is changed. Rural areas become urban, leading to high economic returns and numerous problems mentioned above. The land development, therefore, should consider plans to regulate the development. And to cope with similar problems occurring in others areas in a proper manner since such problems affect not only the local level but also the international level if they have worsened.

From the agricultural-based province became the industrial-based province. Impacts of Land use transformation on natural, economic and society in Chachoengsao province have changed the everyday life of locals. The locals and people who come for works in this area have to share the resources. Chachoengsao also has to face the problems such as pollutions, waste and water management, etc. just as other industrial cities. For the good quality of life for people who live in Chachoengsao, properly developing need to be consider. Not only increase the return of economic but also the security of living.

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